Patent claims

1. Microlithography projection objective for short wavelengths, preferably $\leq$ 193 nm, with an entrance pupil and an exit pupil for imaging an object field in an image field, which represents the segment of a ring field, wherein the segment has an axis of symmetry and an extension perpendicular to the axis of symmetry and the extension is at least 20, and preferably 25 mm, comprising:

a first (S1), a second (S2), a third (S3), a fourth (S4) a fifth (S5), and a sixth mirror (S6) in centered arrangement relative to an optical axis, whereby

each of these mirrors have an off-axis segment, in which the light beams traveling through the projection objective impinge, whereby

the diameter of the off-axis segment of the first, second, third, fourth, fifth and sixth mirrors as a function of the numerical aperture NA of the objective at the exit pupil is $\leq$1200 mm * NA.

2. Microlithography projection objective according to claim 1, wherein the numerical aperture NA at the exit pupil is greater than 0.1, preferably greater than 0.2, most preferably greater than 0.23, and the diameter of the off-axis segment of the first, second, third, fourth, fifth and sixth mirrors is $\leq$ 300 mm.

3. Microlithography projection objective according to one of claims 1 to 2, wherein the first, second, third, fourth, fifth and sixth mirrors each have a volume claim on the rear side of the mirror, which has a depth parallel to the optical axis measured from the front side of the mirror in the off-axis segment, whereby the depth amounts to at least 50 mm for the first, second, third, fourth, and sixth volume claim, and the depth of the volume claim of the fifth mirror is greater than 1/3 the value of the

diameter of the fifth mirror, whereby the respective volume claims are not penetrated.

4. Microlithography projection objective according to one of claims 1 to 3, wherein all volume claims can be extended in a direction parallel to the axis of symmetry without intersecting the light path in the objective or the volume claim of another mirror.

5. Microlithography projection objective according to claim 4, wherein the first, second, third, fourth, fifth and sixth mirrors include an edge region encircling the off-axis segment, and the edge region amounts to more than 4 mm, wherein the light is guided in the objective free of obscuration.

6. Microlithography projection objective according to one of claims 1 to 4, wherein the off-axis segment of the fourth mirror is arranged geometrically between the second mirror and the image plane.

7. Microlithography projection objective according to one of claims 1 to 6, wherein the fourth mirror is arranged geometrically between the third and the second mirrors.

8. Microlithography projection objective according to one of claims 1 to 6, wherein the fourth mirror is arranged geometrically between the first and the second mirrors.

9. Microlithography projection objective according to one of claims 1 to 6, wherein the distance of the mirror vertex along the optical axis from the fourth to the first mirrors (S4 S1) relative to the distance from the second to the first mirror (S2 S1) lies in the range:

$$0.1 < (S4\ S1) / (S2\ S1) < 0.9$$

10. Microlithography projection objective according to one of claims 1 to 8, wherein the distance of the mirror vertex along the optical axis from the third to the second mirror (S2 S3) relative to the distance from the fourth to the third mirror (S4 S3) lies in the range:

$$0.3 < (S3\ S4)\ /\ (S2\ S3) < 0.9$$

11. Microlithography projection objective according to one of claims 1 to 8, wherein the central ring-field radius R, as a function of the numerical aperture NA at the exit pupil, the distance of the mirror vertex along the optical axis from the fifth to the sixth mirror (S5 S6), the distance of the mirror vertex of the fifth mirror from the image plane (S5 B), and the radii of curvature r_5, r_6 of the fifth and sixth mirrors is:

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$$R \geq \tan(\arcsin(NA)) * \left[(S5\ B) + (S5\ S6) - \frac{1}{\frac{2}{r_6} - \frac{1}{r_5 + (S5\ S6)}} \right]$$

12. Microlithography projection objective according to one of claims 1 to 11, wherein the angle of incidence of the chief ray of the field point, which lies on the axis of symmetry in the center of the object field is < 18° on all mirrors.

13. Microlithography projection objective according to one of claims 1 to 12, wherein an intermediate image is formed in the projection objective in the light direction after the fourth mirror (S4).

14. Microlithography projection objective according to one of claims 1 to 13, wherein a diaphragm (B) is arranged in the light path or the beam path on the second mirror (S2).

15. Microlithography projection objective according to one of claims 1 to 14, wherein the first mirror is made convex, and the first, second, third, fourth, fifth and sixth mirrors are aspheric.

16. Microlithography projection objective according to one of claims 1 to 14, wherein the first mirror has zero base curvature, and the first, second, third, fourth, fifth and sixth mirrors are aspheric.

17. Microlithography projection objective according to one of claims 1 to 14, wherein the first mirror is concave and the first, second, third, fourth, fifth and sixth mirrors are aspheric.

18. Microlithography projection objective according to one of claims 1 to 17, wherein all mirrors are made aspheric.

19. Microlithography projection objective according to one of claims 1 to 17, wherein five mirrors at most are aspheric.

20. Microlithography projection objective according to claim 19, wherein the fourth mirror is spherical.

21. Microlithography projection objective according to one of claims 1 to 20, wherein the second to sixth mirrors (S2 S6) are configured in the sequence: concave – convex - concave– convex - concave.

22. Microlithography projection objective device according to one of claims 1 to 21, wherein the objective is telecentric on the image side.

23. Projection exposure system, wherein the projection exposure system comprises an illumination device for illuminating a ring field as well as a projection objective according to one of claims 1 to 22.

24. Process for chip manufacture with a projection exposure system according to claim 23.